Great Lakes RESTORATION at NOAA

The Great Lakes comprise the largest freshwater ecosystem on Earth. The restoration and protection of the Great Lakes is vital as they contain 95 percent of the surface freshwater in the United States and more coastline than the entire East Coast. To contribute to the restoration of the Great Lakes, nearly $1.6 billion has been invested in the region since 2010 by means of the Great Lakes Restoration Initiative (GLRI). As one of 13 Federal Agencies collaborating with U.S. EPA to implement this effort, the National Oceanic and Atmospheric Administration (NOAA) has been allocated over $145 million since 2010 to help accomplish restoration goals using its ground-breaking science, data products and services, predictive capabilities, and partnerships.

NOAA is making significant contributions to the restoration of the Great Lakes through the GLRI by expanding and enhancing many existing programs and implementing new innovative projects that address the GLRI Action Plan.

GLRI Funded Projects

Toxic Substances & Areas of Concern

- Enhanced NOAA Mussel Watch in the Great Lakes
- Modeling Atmospheric Mercury Deposition
- Great Lakes DIVER Data Warehouse, Visualization and Query Tools for AOCs
- Technical Assistance for AOCs
- Manistique River AOC Remediation and Restoration

Nonpoint Source Pollution Impacts on Nearshore Health

- Assessment of Agricultural and Urban Watershed Phosphorus Loading Impacts on HAB Formation and Nearshore Water Quality
- Great Lakes Clean Marina Program
- Applying Green Infrastructure in Waterfront Redevelopment
- Implementation of Nutrient Reduction Projects in Agricultural Watersheds

Invasive Species

- GLANSIS (Great Lakes Aquatic Nonindigenous Species Information System)

Habitats and Species

- Coastal and Estuarine Land Conservation Grant Program
- Area of Concern Habitat Restoration Partnerships

Accountability, Education, Monitoring, Evaluation, Communication, and Partnership

- Implementing a Great Lakes Observing and Response System
- LaMPs and Land Cover Assessment
- B-WET
- Lake Level Viewer

www.regions.noaa.gov/great-lakes/great_lakes-restoration-initiative/

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

Great Lakes Environmental Research Laboratory
4840 S. State Rd.
Ann Arbor, MI 48108
734-741-2235

For more info:

Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

"We must leave the Great Lakes better for the next generation than the condition in which we inherited them."

- Great Lakes Restoration Initiative Action Plan

Toxic Substances and Areas of Concern

funded by the Great Lakes Restoration Initiative

NOAA is working to confront toxics in the Great Lakes. While concentrations of some persistent toxic substances have been significantly reduced in the Great Lakes over the past 30 years, toxins such as polychlorinated biphenyls (PCBs) are still above levels considered safe for humans and wildlife, warranting fish consumption advisories in all five Great Lakes. In addition, chemicals of emerging concern, such as pharmaceuticals, are now being detected in the Great Lakes. NOAA is evaluating hazards from toxic substances so that regulatory and management responses can protect human and ecosystem health.

Enhanced NOAA Mussel Watch in the Great Lakes

NOAA's Mussel Watch Program monitors the status and trends of chemical contamination and associated effects in US coastal waters, including the Great Lakes. GLRI funds have allowed NOAA to place special emphasis on contaminants of emerging concern (CECs), through the evaluation of exposure and bioeffects to mussels. The tissues of mussels, which are filter feeders, are a valuable resource for analyzing chemical and biological contaminant trends. To evaluate implications of CECs, Mussel Watch conducts field monitoring to assess biomarker and/or omics assays on mussels, which provide information on endpoints such as energy metabolism and growth. Expanding the MWP to include CECs is an important complement to AOC remediation investments.

Modeling Atmospheric Mercury Deposition

Regional and global sources continue to deposit mercury to the Great Lakes via the air. Mercury can affect the human nervous system, fish, and wildlife. The most common way that people are exposed to mercury is by eating contaminated fish or shellfish. NOAA is using model output to determine the amount, source, and types of atmospheric mercury deposited in the Great Lakes. Project results will be critical to identifying actions and policies to reduce atmospheric mercury loading in the Great Lakes.

Great Lakes DIVER Data Warehouse, Visualization, and Query Tool for AOCs

High-quality data is critical for decision-making to improve the environment and human health. Thanks in part to GLRI funds, NOAA has been able to transition to a new data warehouse, visualization, and custom query tool called Great Lakes Data Integration, Visualization, Exploration, and Reporting (GL DIVER). Great Lakes DIVER includes all the contaminant chemistry data from Query Manager, as well as benthic and biological datasets. NOAA is currently working with the St. Louis River AOC managers to understand management needs specific to AOCs and subsequently build additional functions in to GL DIVER to address those needs. This gives decision makers and concerned citizens the ability to query across the most comprehensive and highest quality environmental contaminant dataset available. The outcome: accelerated development, implementation, and monitoring of sediment cleanup and restoration projects in the region.

Technical Assistance for AOCs

NOAA is working with partners to advise on and support the design and implementation of sediment removal and habitat improvement projects in Great Lakes Areas of Concern.

For more information contact:

Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

Great Lakes RESTORATION

www.regions.noaa.gov/great-lakes/index.php/great_lakes-restoration-initiative

Invasive Species

funded by the Great Lakes Restoration Initiative

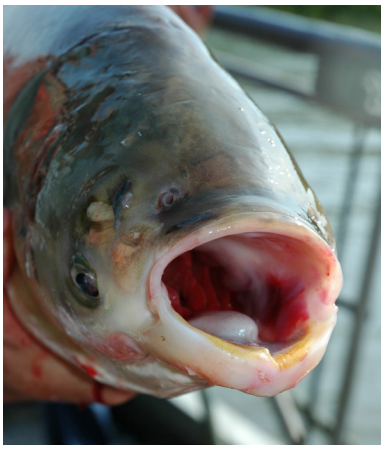
Progress toward restoring the Great Lakes has been significantly undermined by the effects of non-native aquatic, wetland, and terrestrial invasive species. More than 180 nonindigenous aquatic species (NAS) now exist in the Great Lakes. The most invasive of these - including the well known zebra mussel - reproduce and spread, ultimately degrading habitat, out-competing native species, and short-circuiting food webs. Without forecasting the arrival and bioeconomic impact of nonindigenous species, natural resource managers cannot cost effectively respond to current invasions or prevent future invasions.

GLANSIS: Improving Information Access

The Great Lakes Aquatic Non-Indigenous Species Information System (GLANSIS) provides extensive invasive species collection records for the Great Lakes Region. Thanks to GLRI funding, NOAA has expanded GLANSIS to better serve the needs of natural resource managers seeking to halt the spread of non-indigenous species. The expanded GLANSIS includes profiles for range expansion species (native to one part of the basin, but invading other parts) and those forecasted at the highest risk for invasion, as well as risk assessment information and public fact sheets supporting citizen monitoring.

Risk Assessment: Asian Carp

No discussion of Great Lakes invasive species can ignore Asian Carp, which could pose a significant risk if they become established in the Great Lakes ecosystem. Working with experts around the globe, NOAA is developing ecological forecast models that will enhance policies, protocols, and barriers to prevent bighead and silver carp from entering the Great Lakes.



Asian Carp. Credit: Great Lakes Fishery Commission.

Forecasting the Bioeconomic impacts of Aquatic Invasive Species (AIS)

This collaborative project combines scientific, economic, risk analysis, and management expertise to provide the first-ever bioeconomic forecasts of the impact that new aquatic invasive species (AIS) will have on the Great Lakes. This information benefits resource managers, scientists, and policymakers, and it directly supports efforts to control potentially devastating species *before* they get established.

Asian Carp Education and Outreach

This project is using the established outreach and extension programs of the eight Great Lakes Sea Grant programs to respond to opportunities and requests for education and outreach on regional control efforts for Asian carp.

For more information contact:
Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

Great Lakes RESTORATION

www.regions.noaa.gov/great-lakes/index.php/great_lakes-restoration-initiative

Nearshore Health and Non-Point Source Pollution

funded by the Great Lakes Restoration Initiative

The GLRI Action Plan calls for action to identify sources and reduce loadings of nutrients and soil erosion as well as improve public health protection at beaches. NOAA's projects listed below support efforts to improve nearshore areas and reduce nonpoint source pollution in the waters of the Great Lakes.

Assessment of Agricultural and Urban Watershed Phosphorus Loading Impacts on HAB Formation and Nearshore Water Quality

GLRI funds are supporting two projects that measure nutrient concentrations and water quality in the nearshore waters of western Lake Erie and Saginaw Bay, Lake Huron to continue to develop new and enhance existing decision support tools for environmental and public health officials. The projects provide critical in-lake water quality and toxicity observations as well as predictive models that forecast harmful algal bloom location and intensity. The goal of these projects is to understand nutrient transport and offer monitoring information on the formation, growth and toxicity of harmful algal blooms. Decision support tools produced by these efforts will help ensure decision makers have access to the information necessary to safeguard drinking water, alert water treatment plants of changes in water quality, and determine target nutrient loads in agricultural and urban watersheds.

Clean Marina - Stormwater

This project will contribute to implementation of coastal community stormwater management practices, and increase resiliency in the face of changing environmental conditions at marina facilities in the Great Lakes region. Michigan Sea Grant (MSG) will facilitate the implementation of on-the-ground Clean Marina certification efforts, and will also provide coordination and engagement of the Great Lakes Clean Marina Network. Additionally, MSG will oversee a small grants program to support regional Clean Marina certification processes, and enable promotional and recruitment efforts by program coordinators.

Applying Green Infrastructure in Waterfront Redevelopment

This project will provide support to two coastal communities, with the goal of integrating green infrastructure (GI) into their waterfront redevelopment efforts. This project will build upon work funded through the GLRI Economics of Green Infrastructure project, which evaluated the cost of flooding impacts in Duluth, MN, and Toledo, OH, and examined how these communities could use GI to help mitigate and adapt to flooding issues. This project aims to demonstrate how GI can be an important tool for addressing hazard and climate change impacts in the context of waterfront redevelopment.

Improving Coastal Health, Human Health, and Beach Forecasting

Residents and tourists alike are drawn to Great Lakes beaches, nearshore waters, and tributaries. Unfortunately, these waters and shorelines can experience unsafe levels of E. coli and growth of Harmful Algal Blooms (HABs), both of which can be detrimental to human health and frequently force closure of beaches. NOAA's Great Lakes Environmental Research Laboratory (GLERL) is working to address these problems. GLRI funds are helping to support GLERL's work to develop models that forecast the locations of HABs and E. coli concentrations, in turn giving resource managers the tools to make more timely actions to protect human health.

Implementation of Nutrient Reduction Projects in Agricultural Watersheds

NOAA is creating multi-agency partnerships with the Great Lakes states to implement Agricultural Nutrient Runoff Risk Advisory Forecast Services, using GLRI funding. The goal of the service is to implement a web-based decision support tool, driven by real-time modeling, which provides information to agricultural nutrient applicators up to ten days into the future. The desired outcome is for applicators to avoid spreading nutrients prior to forecasted hydrologic events such as rainfall and snow melt, where environmental models indicate runoff of the nutrients is likely.

For more information contact:

Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

Great Lakes RESTORATION

www.regions.noaa.gov/great-lakes/index.php/great_lakes-restoration-initiative

Habitat and Species Protection and Restoration

funded by the Great Lakes Restoration Initiative

The health of Great Lakes habitats and wildlife depends upon the protection and restoration of ecosystems. A multitude of threats affect the health of Great Lakes habitats and wildlife, and many opportunities exist to protect and restore critical elements of the Great Lakes ecosystem.

Habitat Restoration and Partnerships

NOAA's Restoration Center in the Great Lakes provides financial and technical assistance to remove dams and barriers, construct fish passage, construct fish passage, restore coastal wetlands and riparian areas, and remove invasive species in Great Lakes Areas of Concern. In addition, NOAA's Restoration Center also supports partnerships that allow for a targeted approach to address priority projects in Great Lakes Areas of Concern including design and engineering of habitat restoration projects, on-the-ground restoration work, project evaluation to inform future restoration efforts, and climate change expertise to inform restoration planning and implementation.

Black River, Lorain, OH. Four GLRI-funded projects in the Black River Area of Concern include the construction of 5000+ linear ft. of fish habitat shelves, approximately 1500 ft. of riverbank stabilization and restoration, the removal of 45,000 cubic yards of steel slag, the restoration of 2.3 acres of riparian habitat, the engineering and design of additional in-stream and bank restoration, and the treatment of invasive species.

Coastal and Estuarine Land Conservation Program

NOAA's Coastal and Estuarine Land Conservation Program (CELCP) preserves and protects habitats with exceptional ecological, historical, and recreational value. CELCP was established in 2002 as a nation-wide program to assist local and state agencies with protecting and conserving important coastal and estuarine habitats. GLRI funding has enabled CELCP to expand protection of vital Great Lakes coastal and estuarine habitat. To date, 2420 acres of pristine Great Lakes coastal land has been permanently protected through the GLRI's supplemental funding to CELCP.

AOC Land Acquisition Project

The Great Lakes Areas of Concern (AOC) Land Acquisition Project is modeled after the CELCP program. However, instead of solely focusing on ecologically intact habitat, the AOC Land Acquisition Project also targets areas that are high priority for habitat restoration. The Land Acquisition Project provides GLRI funds so that state and local agencies can purchase land in AOCs. Acquiring damaged habitat is the first step in establishing a pipeline of GLRI-supported restoration projects, which specifically work to remove habitat-related beneficial use impairments (BUIs).

Mashek Creek Property Protection. NOAA and the Wisconsin Coastal Management Program are working together to support the permanent protection of the 26.87 acre Mashek Creek property.

For more information contact:

Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

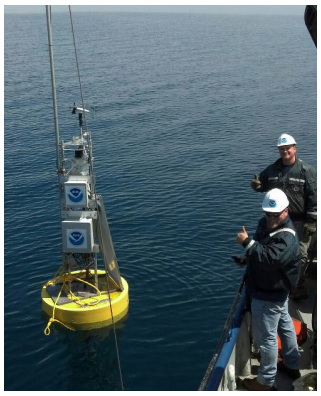
Great Lakes RESTORATION

www.regions.noaa.gov/great-lakes/index.php/great_lakes-restoration-initiative

Foundations for Future Restoration Actions

funded by the Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative Action Plan requires oversight, monitoring, assessment, and coordination to succeed. NOAA is contributing to these needs by establishing a coordinated network of scientific observations, educating the next generation of Great Lakes citizens, and providing information for decision makers about the impacts of climate change. These projects are helping provide the scientific data, education, and collaboration necessary to sustain this investment in Great Lakes restoration.



Implementing a Great Lakes Observing and Response System

NOAA's Great Lakes Synthesis, Observations, and Response System (SOAR) coordinates and integrates coastal ecosystem observations that support Great Lakes restoration projects, including AOC restoration. GLRI funds have been integral to developing and honing the system, which uses scientific models and observations from on-water and remote sensing platforms to create database products for assessment and decision support. SOAR is focused on Areas of Concern and restoration projects within the Great Lakes. However, its value extends far beyond the region, since SOAR observations feed into a global observation network.

Lake Level Viewer

GLRI funds will expand the coverage and capabilities of the first-generation Lake Level Viewer visualization tool. This tool helps users visualize lake level changes that range from six feet above to six feet below historical long-term average water levels in the Great Lakes, along with potential shoreline and coastal impacts. Communities can use this information to determine what preparations make the most sense in planning for water level change scenarios. Images of local community landmarks, together with maps showing water level scenarios, convey the potential physical, social and economic impacts of lake level change in the U.S. Great Lakes. Access the viewer at coast.noaa.gov/digitalcoast/tools/llv.

LaMP Support and Land Cover Assessment

GLRI funds are supporting the Coastal Change Analysis Program (C-Cap) to update land cover assessments for the five Great Lakes. C-CAP produces a nationally standardized database of land cover and land change information for the coastal regions of the U.S. Having updated standardized data on land cover, land use change and accurate inventories of the coastal areas, wetlands and the adjacent uplands in the tributaries that effect each lake is a priority project identified by all five LaMPs, and provides foundational information needed to make decisions about other LaMP activities and projects.

B-WET

The Great Lakes NOAA Bay-Watershed Education and Training (B-WET) Program is an environmental education program that supports experiential K-12 learning through local competitive grant awards. Great Lakes B-WET is part of the national B-WET Program, and was established in 2011 with GLRI funding. Carefully selected classroom and outdoor educational experiences, driven by rigorous academic learning standards, engender discovery and wonder in students while nurturing a sense of community that connects them with their watershed, reinforces an ethic of responsible citizenship, and promotes academic achievement. As of 2015, the B-WET Program has engaged 27,430 students and 960 teachers in place-based watershed education.

For more information contact:

Rebecca Held Knoche
NOAA GLRI Program Coordinator
301-563-1166
rebecca.held@noaa.gov

Great Lakes RESTORATION

www.regions.noaa.gov/great-lakes/index.php/great_lakes-restoration-initiative